



## The final words from the RE<sup>4</sup> Project Coordinator (CETMA)

RE<sup>4</sup>-project is now close to the take the final steps of its successful journey, lasted three years and a half and paved by encouraging results and large interest from the technical and general community.

RE<sup>4</sup> has started in September 2016 with the ambition of contributing to the achievement of the key challenges identified by the Europe 2020 strategy, which requires EU Member States to re-use, recycle and recover a minimum of 70% by weight of non-hazardous CDW.

Now, at the beginning of 2020, RE<sup>4</sup> is ready to provide innovative technologies and reliable strategies for the design and manufacturing of structural and non-structural pre-fabricated elements with high degree (up to 85%) of recycled materials and reused structures from partial or total demolition of buildings.

RE<sup>4</sup>'s success was built on four main "pillars": maximising the amount of valuable CDW recovered; designing reusable building components; improving CDW management through digitization; and increasing the acceptance of CDW-based products among the end-users.

Starting with the development of an advanced robotic sorting system to improve the quality of sorted materials with main focus on those with high economic value such as sand, new quality classes for CDW-derived aggregates were identified together with optimal recycling strategies for each of each mineral and lightweight CDW fractions, with potential applications.

This led to the verification of CDW recycling potential with the development, testing and up-scaling (from the laboratory to the prefabrication scale) of:

- 5 new concrete-based materials with different properties and with an average virgin material replacement in the final product in the range of 50-85%
- 4 new components – blocks, tiles, timber components, insulating panels – and 4 new prefabricated elements – concrete and timber façade panels, load-bearing concrete elements, internal partition walls with an average virgin material replacement in the final product in the range of 50-85%.

In terms of reuse potential, the RE<sup>4</sup> has developed innovative design concepts for a fully prefabricated, easy dismountable RE<sup>4</sup> building, with up to 90% of reusable structures (i.e. reversible connections).

Moreover, RE<sup>4</sup> has developed a BIM-compatible Decision Support System (DSS) able to support owners and construction/demolition companies in CDW management improvement.

RE<sup>4</sup> paid also special attention to the acceptance and trust on CDW-based products by end-users. This was done by means of an intensive plan made of a large study on CDW management across Europe, performance assessment, certification and standardisation strategies, Life-cycle analyses (including s-LCA), HSE analyses, and training activities.

All solutions developed in the project have been integrated, validated, and showcased in real scale demo buildings across Europe and beyond. 2 two-storey new constructions demo-buildings (at ACCIONA demo-park in Spain and CREAGH premises in UK), representatives of building archetypes across Europe (i.e. type of building, climate, energy mix, design, etc.). The demonstration of the strategy for disassembly and reuse of materials and structures from dismantled buildings has taken place in ACCIONA demo building. The RE<sup>4</sup> solutions for refurbishment have been applied to suitable existing buildings (Italy and Taiwan). Seismic performances of RE<sup>4</sup> solutions have been also verified through shaking table testing.



At this final stage of the project, RE<sup>4</sup> solutions show the potential to create significant spill-overs for the entire society with new and high-skilled job opportunities and businesses in the green economy, and positive effects on the environment. In fact, the new CDW-based materials and components have lower environmental impacts than conventional ones, with more than 50% saving in terms of CO<sub>2</sub> emissions, and savings in the consumption of energy and raw materials. They are also more than 20% cheaper to produce.

Nowadays, the full application of circular model in Construction sector is not easy to be reached due to several obstacles and bottle-necks to overcome. There is still a strong need of improved waste identification, separation and collection at source, quality assessment procedures and, mainly, policy and framework conditions that can foster the transition to a circular economy in Construction. But, the lesson learned from RE<sup>4</sup> experience is that a fully recycled and recyclable building is possible!

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